

Claims

- [001] A camshaft adjusting system (200), comprising a camshaft adjusting device (100) with two opposed hydraulic chambers (102, 104), in particular an oscillating motor camshaft adjusting device, and a control valve group (1),
5 the control valve group of which works as a 4/4-way valve (1), with a connection (A) for the first hydraulic chamber (102), with a connection (B) for the second hydraulic chamber (104), with a tank connection (T) and with a connection (P) for pressurisation,
10 wherein
in a first state (I) the camshaft adjusting system (200) is pressure-relieved with respect to the tank connection (T), the pressureless state, by means of the valve (1) by simultaneously hydraulically
15 connecting the two connections (A, B) for the hydraulic chambers (102, 104) of the camshaft adjusting device (100).
- [002] A camshaft adjusting system (200) as claimed in claim 1, also wherein
20 the first state (I) is the operating end time state of the camshaft adjusting system.
- [003] A camshaft adjusting system (200) as claimed in any one of the preceding claims, also wherein
25 the control valve group consists of a single 4/4-way valve (1).
- [004] A camshaft adjusting system (200) as claimed in claim 3, also wherein
a further state of the states (I; II, III, IV) of the 4/4-way valve (1) is a
second state (II), the retarded adjustment, in which the connection (A)
for the first hydraulic chamber (102) is connected to the tank
30 connection (T), while the connection (B) for the second hydraulic chamber (104) is connected to the connection (P) for pressurisation (202),

a further state of the states (I; II, III, IV) of the 4/4-way valve (1) is a third state (III), the holding position, in which the hydraulic chamber connections (A, B) are simultaneously disconnected from the tank connection (T) and the connection (P) for pressurisation (202),
5 a further state of the states (I; II, III, IV) of the 4/4-way valve (1) is a fourth state (IV), the advance adjustment, in which the connection (A) for the first hydraulic chamber (102) is connected to the connection (P) for pressurisation (202), while the connection (B) for the second hydraulic chamber (104) is connected to the tank connection (T).

10 [005] A camshaft adjusting system (200) as claimed in claim 4, also wherein the states (I; II, III, IV) can be started through a linear movement of a hydraulic piston (13), whose sequence of the states (I; II, III, IV) follows the ordinal number of the states, wherein it is in each case
15 possible to move into the next higher or lower ordinal number state.

[006] A camshaft adjusting system (200) as claimed in any one of the preceding claims, also wherein
20 the 4/4-way valve (1) is a cartridge valve (1) which lies in a bushing (15), is spring-biased (9) on one side and has hydraulic hollow pistons (13) for tank pressure relief,
the states (I; II, III, IV) of which are determined by an overlap (Ü1, Ü2, Ü3) between the hollow piston (13) and the bushing (5).

25 [007] A camshaft adjusting system (200) as claimed in any one of the preceding claims 1 to 6, also wherein,
when the camshaft adjusting system (200) is in the pressureless state (I), the camshaft adjusting device (100) automatically moves into a defined dwell position during the period of the first state (I).

30 [008] A camshaft adjusting system (200) as claimed in any one of the preceding claims,

also wherein

the camshaft adjusting device (100) is provided with a locking mechanism (106) which locks in when the hydraulic chambers (102, 104) are in the pressureless state (I) and unlocks when a pressure difference between the hydraulic chambers (102, 104) is exceeded.

[009] An internal combustion engine with an engine control unit and a camshaft adjusting system (200) as claimed in any one of claims 1 to 8, wherein

the turn-off state of the camshaft adjusting system (200) is determined by a no-load voltage, a no-load current or a no-load pulse-width signal which lies below a threshold value.

[010] A method of operating an internal combustion engine, in particular in a motor vehicle, with an electronic engine control unit and a camshaft adjusting system as claimed in claims 1 to 8, in which the first state (I) is taken up upon starting the internal combustion engine with co-ordination between the control unit and the camshaft adjusting system, in particular independently of the process of switching off the internal combustion engine.